MATHEMATICAL AND COMPUTATIONAL SCIENCES
DIVISION COLLOQUIUM

SYNCHRONIZING NON-DISSIPATIVE CHAOS FOR SPREAD SPECTRUM COMMUNICATIONS

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ABSTRACT

Over the past decade an increasing amount of applied mathematical research has been devoted to studying the synchronization of chaotic systems. One of the most promising applications of synchronized chaos has appeared in the communications industry: spread spectrum (SS) modulation. With a single exception, studies of chaotic SS communication systems have used *dissipative* chaotic dynamics. Though physically more natural than their non-dissipative counterparts, dissipative chaotic systems are ill-suited for SS applications (for reasons that I will discuss in detail during this talk).

Beginning with an introduction to SS modulation I will describe chaotic SS using dynamics that not only lack dissipation, but are *ergodic*. The mathematical object beneath every chaotic SS communication system is a coupled non-autonomous dynamical system. Basic functional requirements of the communication system can be formulated as precise statements about the behavior of the underlying dynamics. In the system I will describe, the ergodic nature of the uncoupled dynamics provides a foothold from which to launch a formidable analytical attack on a fundamental question, "Is the synchronized state globally (asymptotically) stable?". I will show that almost every initial condition leads to a synchronized state. Of further practical interest, I will give estimates of the synchronization time that provide a clear picture of the synchronization performance.

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